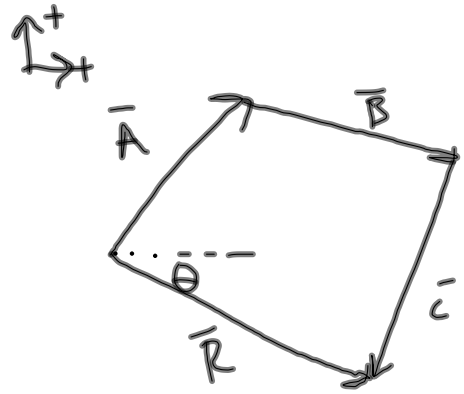
$\bar{A} = 50\ N$ @ $45°$ N of E

$\bar{B} = 48\ N$ @ $12°$ S of E

$\bar{C} = 61\ N$ @ $71°$ S of W

Add these together.

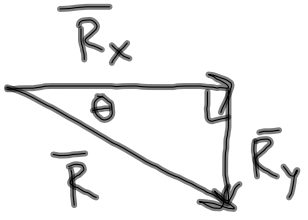


$A_x = 35.35\ N$ $\quad A_y = 35.35\ N$

$B_x = 46.95\ N$ $\quad B_y = -9.97\ N$

$C_x = -19.86\ N$ $\quad C_y = -57.68\ N$

$R_x = 62.44\ N$ $\quad R_y = -32.3\ N$



$R = 70.29\ N$

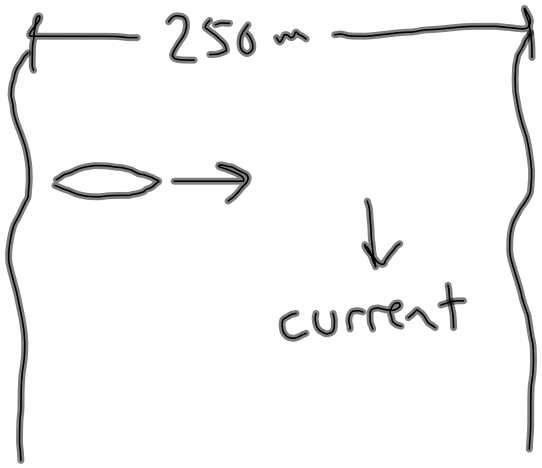
$\theta = 27.35°$

S of E

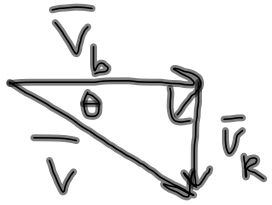
$\bar{R} = 70.29\ N$ @ $27.35°$ S of E

Practice Problems 3.30.12 CP Physics

A boat has a velocity of 10 m/s due east, and the river in which the boat is in has a current with a velocity of 3 m/s south and is 250 m wide.
a) What is the overall velocity of the boat (magnitude, angle, direction)?
b) How far does the boat go downstream before it reaches the other side?



a)



$\bar{V} = 10.44$ m/s @ 16.7° S of E

b)

$$V_b = \frac{\Delta x}{\Delta t}$$

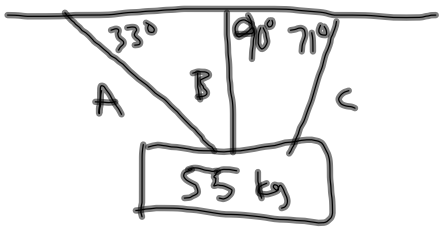
$$\Delta t = \frac{\Delta x}{V_b} = \frac{250\text{ m}}{10\text{ m/s}} = 25\text{ s}$$

$$V_R = \frac{\Delta y}{\Delta t}$$

$$\Delta y = V_R \Delta t = (3\text{ m/s})(25\text{ s}) = 75\text{ m}$$

Practice Problems 3.30.12 CP Physics

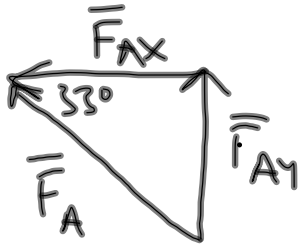
Three rods are holding an object that has a mass of 55 kg. The rod on the left makes an angle of 33 degrees with the ceiling, the rod in the middle is perpendicular to the ceiling, and the rod on the right has an angle of 71 degrees with the ceiling. Find the tension on each rod.



$$F_g = m a_g = 539\ N$$

$$F_{AY} = F_B = F_{CY} = \frac{539\ N}{3} = 179.7\ N$$

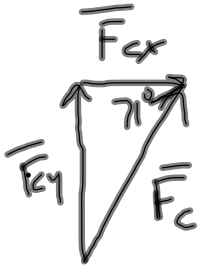
$$F_B = 179.7\ N$$



$$\sin(33°) = \frac{F_{AY}}{F_A}$$

$$F_A = \frac{F_{AY}}{\sin(33°)}$$

$$= 329.9\ N$$

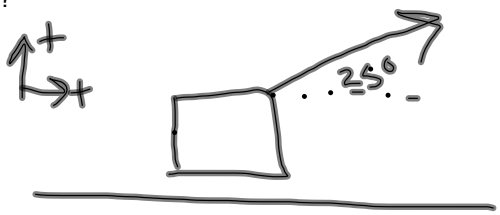


$$F_C = \frac{F_{CY}}{\sin(71°)}$$

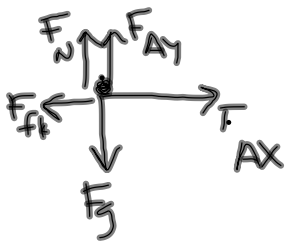
$$= 190\ N$$

Practice Problems 3.30.12 CP Physics

A box is being pulled along a horizontal surface with a rope that has an angle of 25 degrees with the horizontal. The box has a mass of 8 kg and a coefficient of kinetic friction of 0.17. If the applied force on the rope is 48 N, what is the acceleration of the box?



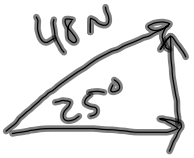
FBD:



$$\sum F_x = ma_x$$

$$a_x = \frac{\sum F_x}{m} = \frac{F_{AX} - F_{fk}}{m}$$

$$= \frac{43.5\,N - 9.87\,N}{8\,kg} = 4.2\,m/s^2$$



$F_{AX} = 43.5\,N$

$F_{AY} = 20.28\,N$

$F_{fk} = \mu_k F_N$

$= (.17)(58.11\,N)$

$= 9.87\,N$

$\sum F_y = \emptyset$

$F_N + F_{AY} - F_g = \emptyset$

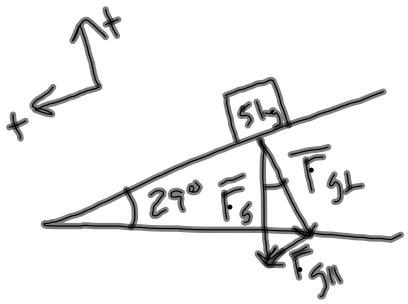
$F_N = F_g - F_{AY}$

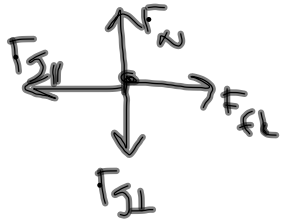
$= mg - F_{AY}$

$= 58.11\,N$

Practice Problems 3.30.12 CP Physics

A 5 kg box is moving with a constant velocity down an incline, and the incline has an angle of 29 degrees with the horizontal. What is the coefficient of kinetic friction that exists between the box and the incline?





$$\mu_k = \frac{F_{fk}}{F_N}$$

$$= \frac{23.75\,N}{42.85\,N}$$

$$= 0.554$$

$$\sum F_{\parallel} = \emptyset$$

$$F_{g\parallel} - F_{fk} = \emptyset$$

$$F_{fk} = F_{g\parallel}$$

$$= mg\sin(29°)$$

$$= 23.75\,N$$

$$\sum F_{\perp} = \emptyset$$

$$F_N - F_{g\perp} = \emptyset$$

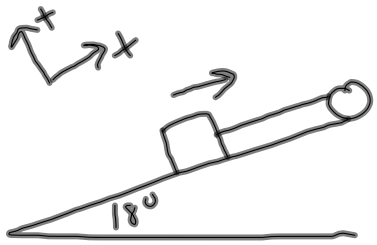
$$F_N = F_{g\perp}$$

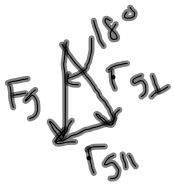
$$= mg\cos(29°)$$

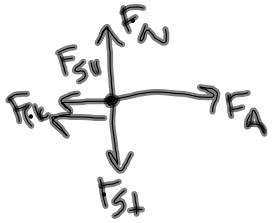
$$= 42.85\,N$$

Practice Problems 3.30.12 CP Physics

A rope attached to an engine pulls a 250 N crate up an 18 degree incline with an acceleration of 1.1 m/s/s. The coefficient of kinetic friction is 0.26. What is the magnitude of the force that the rope exerts on the crate parallel to the ramp?







$F_{g\parallel} = 77.25N$

$F_{g\perp} = 237.76N$

$\Sigma F_{\parallel} = ma_{\parallel}$

$F_A - F_{fk} - F_{g\parallel} = ma_{\parallel}$

$F_A = F_{fk} + F_{g\parallel} + ma_{\parallel}$

$= 61.81N + 77.25N + (25.5kg)(1.1 m/s^2)$

$= 167.1N$

$F_{fk} = \mu_k F_N$

$= (.26)(237.76N)$

$= 61.81N$

$\Sigma F_{\perp} = \emptyset$

$F_N - F_{g\perp} = \emptyset$

$F_N = F_{g\perp}$

$= 237.76N$